IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

TITLE

ELECTRICAL CONNECTOR

INVENTORS AND POST OFFICE ADDRESSES

Michael J. Bonavita
RD 1, Box 1163
Russell, PA 16345

Steven M. Boyd
210 Jackson Avenue
Warren, PA 16365

Ronald E. Thomas
404 River Road
Warren, PA 16365

Richard P. Walker
RD 1
Saegertown, PA 16433

Douglas G. Seymour
47 Grandview Avenue
Lakewood NY 14750

TECHNICAL FIELD

This invention relates to electrical connectors and more particularly to miniature electrical connectors having superior alignment capabilities during assembly, increased contact density and ruggedness suitable for automotive applications.

BACKGROUND ART

Electrical connectors are used in multiple applications in many areas. Particularly prevalent is their use in automobiles where the current emphasis has been on combining great reliability, miniaturization and reduced cost. These features have been absent from the connectors now on the market.

DISCLOSURE OF INVENTION

It is, therefore, an object of the invention to obviate the disadvantages of the prior art.

It is another object of the invention to enhance connector assembly operations.

It is yet another object of the invention to provide a connector that is economical to manufacture, small in size yet provided with increased density of contacts.

It is still another object of the invention to provide a connector housing having provisions for accepting electrical contacts that are of less than perfect configuration.

These objects are accomplished, in one aspect of the invention, by an electrical connector that comprises an electrically insulating housing having a front end and a back end displaced along a longitudinal axis. An electrical contact receiving aperture is formed in the housing and is arrayed parallel to the longitudinal axis. The back end of the connector housing further includes a contact receiving entrance that has a given cross-sectional, one-way footprint and has a given length "L" along the longitudinal

axis. An electrical contact is positioned in the contact-receiving aperture, and has the same cross-sectional, one-way footprint as the entrance. At least a portion of the longitudinal length of the contact, designated "L1" is sufficient to retain engagement with the contact receiving entrance until the contact enters the electrical contact-receiving aperture in the insulating housing.

The one-way footprint assures correct alignment of the contact with the housing aperture and allows for a much smaller contact with lesser spacing between contacts, thus allowing for a greater contact density and a miniaturization of the connector.

In a preferred embodiment of the invention, the contact receiving aperture in the housing has a slightly larger cross-section than that of the contact and, additionally, has a grosser shape than that of the given, one-way, cross-sectional footprint, which permits slightly misaligned or crooked contacts to still be fed into the connector housing. This provision, which allows the connector to accept contacts of less than perfect configuration, reduces the cost of assembly of the connector. In a still further embodiment, the contact-receiving aperture in the connector housing includes a locking tongue that fixedly holds a completely inserted contact within the aperture.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a connector housing in accordance with an aspect of the invention;

Fig. 2 is an elevational, sectional view of the connector of Fig. 1;

Fig. 3 a is view similar to Fig. 2 with a contact partially inserted and engaging the locking tongue;

Fig. 4 is a view similar to Fig. 3 with a contact completely inserted and the locking tongue disabler in position;

Fig. 5 is a perspective view of the gasket retainer illustrating one embodiment of a one-way, cross-sectional area;

Fig. 6 is a diagrammatic view of the one embodiment of the one-way cross-sectional area;

Fig. 7 is a perspective view of a contact employing the one-way cross-sectional area;

Fig. 8 is a front elevational view of the contact of Fig. 7; and

Fig. 9 is a perspective view of one form of locking tongue disabler.

BEST MODE FOR CARRYING OUT THE INVENTION

For a better understanding of the present invention, together with other and further objects, advantages and capabilities thereof, reference is made to the following disclosure and appended claims taken in conjunction with the above-described drawings.

Referring now to the drawings with greater particularity, there is shown in Fig. 1 an electrical connector 10 having an electrically insulating housing 12, a front end 14 and a rear end 16, displaced along a longitudinal axis 18 (see Fig. 2.). A plurality of electrical contact receiving apertures 20 extends through the housing 12.

Formed interiorly of aperture 20 is a locking tongue 24 having a cam edge 24a and contact stop 24b. A flexible gasket 26 is positioned at the rear end 16 of housing 12 and fits inside a housing extension 12a and contains a plurality of contact receiving gasket apertures 32, alike in number and location to apertures 20.

A gasket retainer 30 is fitted over housing extension 12a and fixed thereon by at least one cammed boss 12b on housing extension 12a engaging a formed opening 30b in a peripheral wall 30c of the gasket retainer 30. The gasket retainer 30 is provided with

a plurality of electrical contact receiving entrances 32, each of which entrances having a given cross-sectional, one-way footprint 34. One embodiment of such a footprint is shown diagrammatically in Fig. 6 as comprising a basic quadrangle with a corner missing. The configuration is shown also in Fig. 5 which also illustrates a preferred embodiment wherein the entrances 32 of one row are oriented 180° from the other row.

An electrical contact 36 (Fig. 7) is positioned in housing aperture 20. By way of example, the contact 36 can be similar to one shown in U.S. Patent No. 5,941,741. In this instance the electrical contact 36 is a female contact having a hollow, male receiving contact portion 36a which has the same cross-sectional, one-way footprint as entrance 32 so that contact 36 can be inserted into the housing 12 only one way. Positioned rearwardly from contact receiving portion 36a is a wire receiving portion 36b that has a second cross-sectional area smaller than cross-sectional area of the footprint. Area 36b is provided with wings 36d for crimping a stripped wire and wings 36e for crimping about the wire insulation, thus firmly attaching an electircal wire 36f (see Fig.4) to the contact 36. Because the entrance 32 in gasket retainer 30 provides the necessary orientation, as will be described more fully hereinafter, it is not necessary for the electrical contact receiving aperture 20 in housing 12 to have the same footprint. Actually, it is preferred that aperture 20 have a grosser configuration than the contact. By "grosser" is meant a more regular configuration that will accept the one-way cross-section without requiring the original orientation. In this particular case, the cross-section of aperture 20 can be simply quadrangular, greatly simplifying the manufacture of housing 12 and reducing the cost. This feature also allows the insertion of a contact 36 that may have been slightly malformed during the wire crimping operation. Also, while the one-way cross-sectional area of this particular contact 36 has been shown to be a modified quadrangle formed by using an overlapping fold 36g on the top of the contact , it is to be understood that other unique cross-sections could be employed, such as elliptical or triangular. The important feature is that the entrance 32 and the initial or front portion of the contact 36 share the same cross-section and that this cross-section permits only a single, desired orientation.

When the contact 36 is fully inserted as shown in Fig. 4, the front of the contact will abut stop 14a while the contact stop 24b on flexible locking tongue 24 engages the rear lip 36c of the contact 36, thus completely fixing the contact 36 within aperture 20.

Also important in insuring the proper alignment of contact 36 is the longitudinal length L1 of the male contact-receiving portion 36a. This length is at least as long as the length L, shown in Fig. 3, which is the length of the distance from the back end 16, containing the footprint 34, to the beginning of the aperture 20. This insures that the very front of contact 36 enters the aperture 20 before rear lip 36c of contact 36 leaves the orientation feature of the footprint.

As the contact continues its insertion into the aperture 20, the front end of contact 36 engages the cam 24a of the displaceable locking tongue 24 and lifts it into the space 24c. Upon the completion of the insertion, when contact 36 hits stop 14a, the tongue 24 will flex back to its original position and contact stop 24b will engage the rear lip 36c of contact 36. Then the locking tongue disabler 38 is pushed into position from the front end 14 of housing 12 thus preventing future movement on tongue 24 while the disabler is in position. This locking tongue disabler is shown in perspective view in Fig. 9. The disablers 38, one for each contact, project from a base 38a containing a plurality of male contact receiving openings 38b alike in number and location to the apertures 20. The locking tongue disabler is held in its fixed and operative position by prongs 40 formed on the housing 12 engaging slots 40a formed on an interior surface of disabler 38.

While there have been shown and described what are at present considered the preferred embodiments of the invention, it will be apparent to those skilled in the art that various changes and modifications can be made herein without departing from the scope of the invention as defined by the appended claims.